Fig. 1

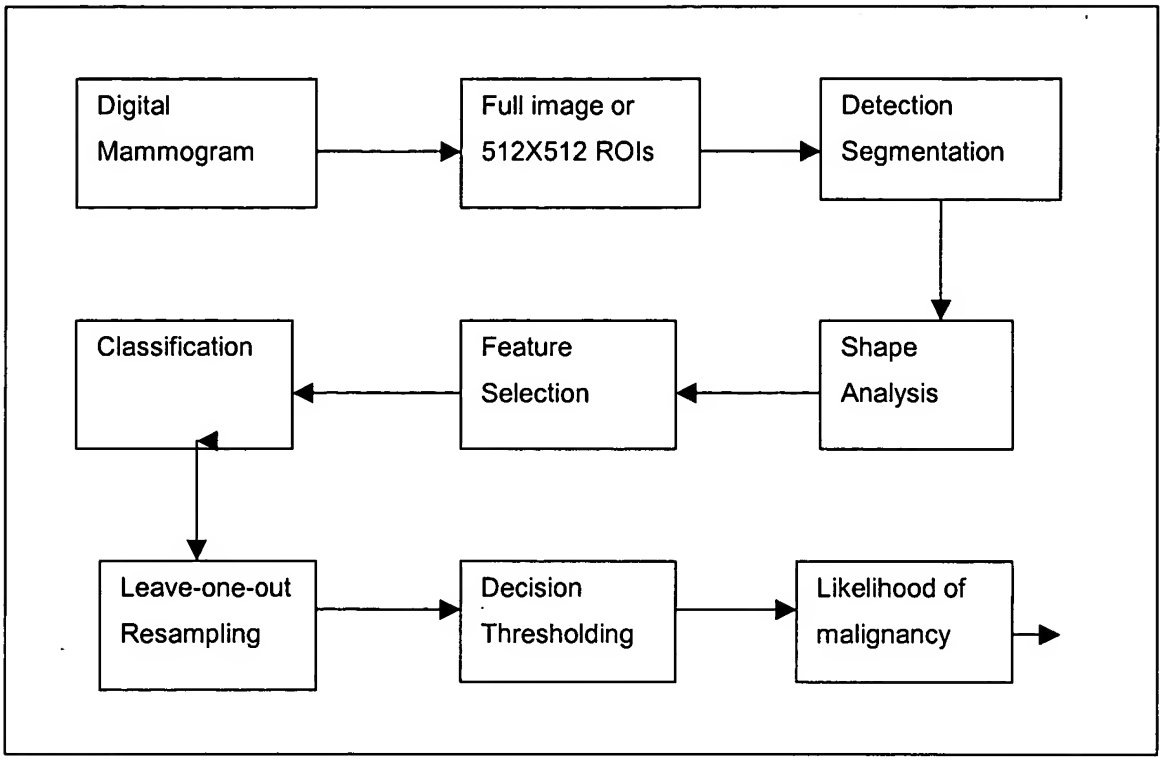

Digital Mammogram
Full image or 512X512 ROIs
Detection Segmentation
Shape Analysis
Feature Selection
Classification
Leave-one-out Resampling
Decision Thresholding
Likelihood of malignancy

Fig. 2

$$C=\frac{P^2}{A} \quad or \quad C=\frac{P^2}{4\pi A} \quad or \quad C=1-\frac{4\pi A}{P^2} \quad or \quad C=\frac{A_1}{A}$$

Fig. 3

$$P=N_e+\sqrt{2}\,N_o$$

Fig. 4

$$FF=\frac{\left[\sum_{n=-N/2+1}^{N/2}\left\|NFD(n)\right\|/|n|\right]}{\left[\sum_{n=-N/2+1}^{N/2}\left\|NFD(n)\right\|\right]}$$

Fig. 5

$$NFD(n)=\begin{cases}0; & n=0\\ S(n)/S(1); & n=1,2,\ldots,N/2\\ S(n+N)/S(1); & n=-1,-2,\ldots,-N/2+1\end{cases}$$

Fig. 6

$$S(n) = \frac{1}{N}\sum_{k=0}^{N-1} s(k)\exp[-j2\pi nk / N],\ n=0,1,2,\ldots,N-1,$$

Fig. 7

$$m_p = \frac{1}{N}\sum_{i=1}^{N}[z(i)]^p$$

Fig. 8

$$\mu_p = \frac{1}{N}\sum_{i=1}^{N}[z(i) - m_1]^p$$

Fig. 9

$$M = \frac{(\mu_4)^{1/4}}{m_1} - \frac{(\mu_2)^{1/4}}{m_1}$$

Fig. 10

$$\varepsilon = \frac{(m_{2,0} - m_{0.2})^2 + 4m_{1,1}^2}{(m_{2,0} + m_{0.2})^2}$$

Fig. 11

$$m_{pq} = \sum_{x} \sum_{y} x^p y^q f(x, y)$$

Fig. 12

$$S = \mu_{0,2} + \mu_{2,0}$$

Fig. 13

$$\mu_{pq} = \sum_{x} \sum_{y} (x - \bar{x})^p (y - \bar{y})^q f(x, y)$$

Fig. 14

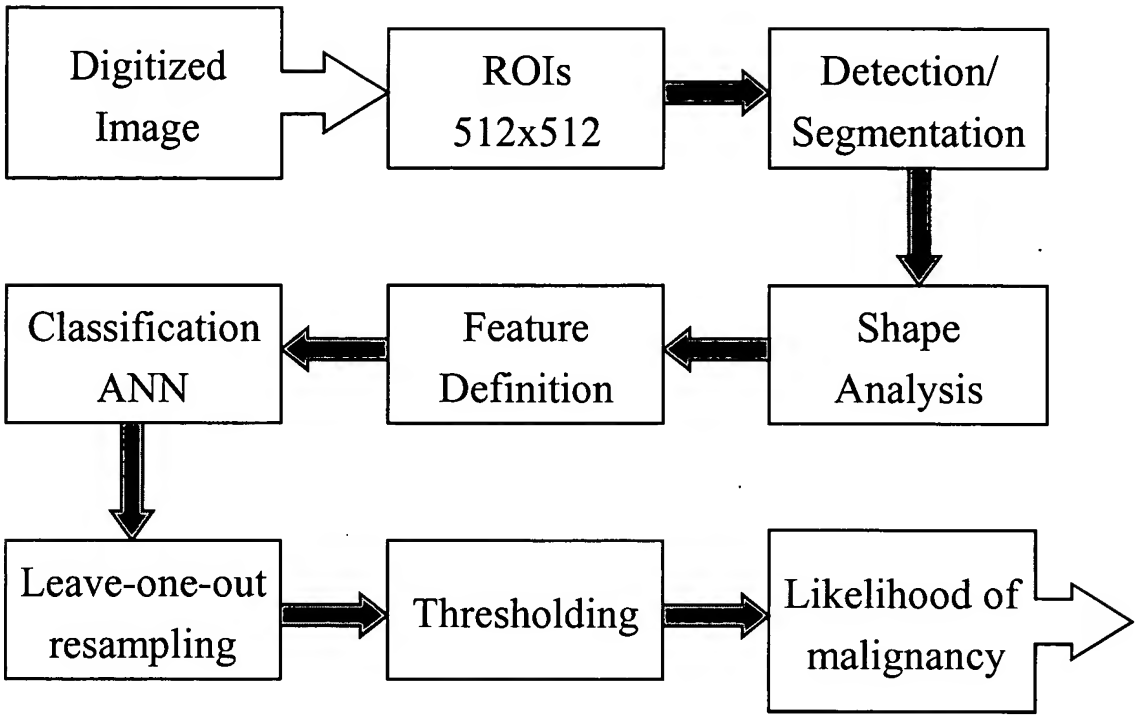

Digitized Image
ROIs 512x512
Detection/ Segmentation
Shape Analysis
Feature Definition
Classification ANN
Leave-one-out resampling
Thresholding
Likelihood of malignancy

Fig. 15 (a)

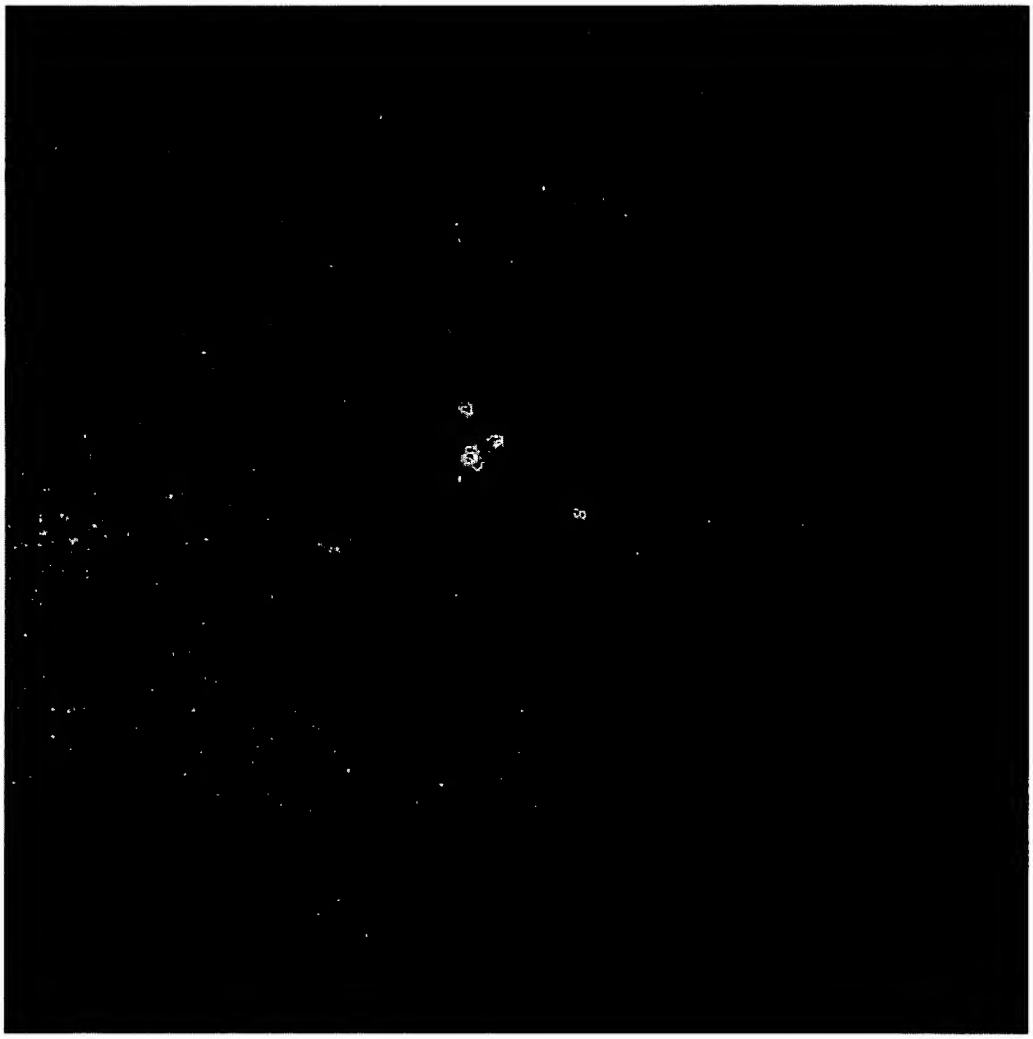


Fig. 15(b)

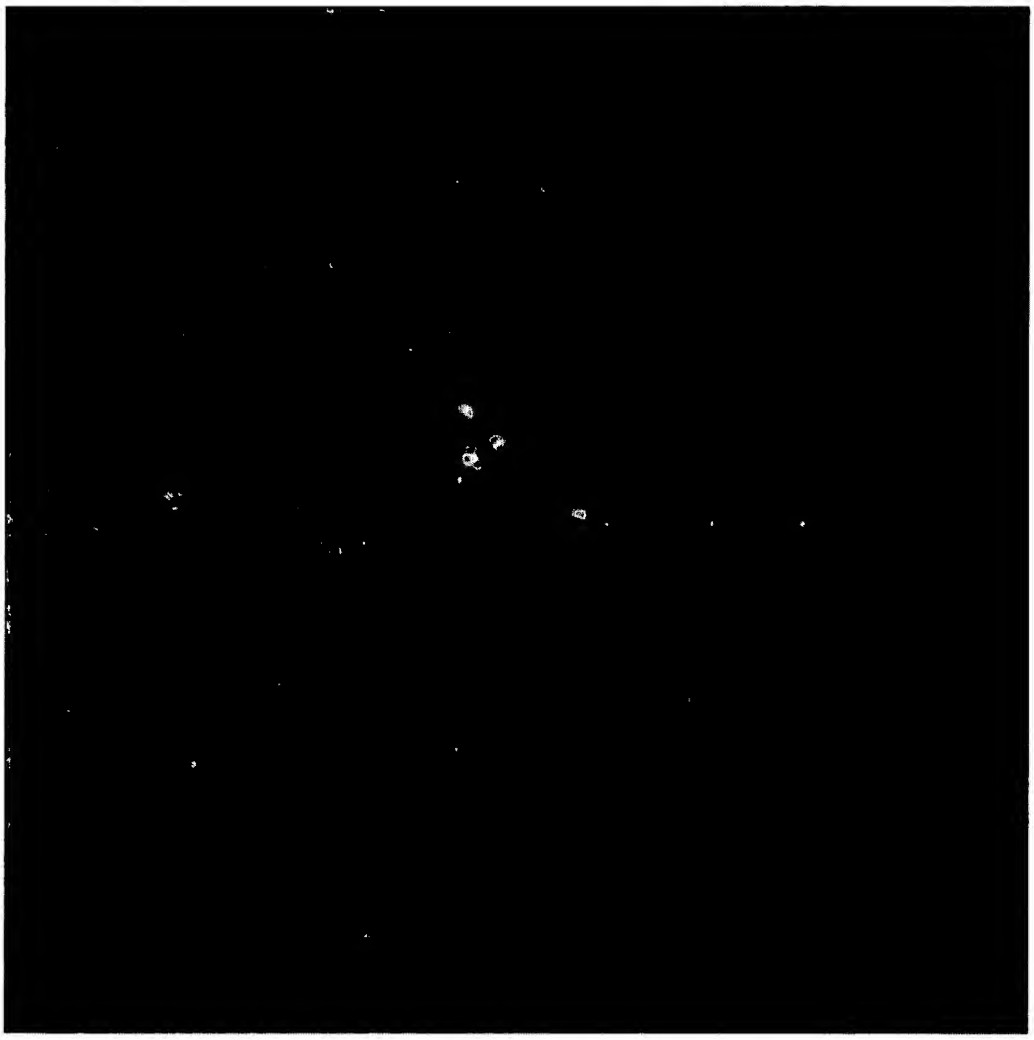


Fig. 15(c)

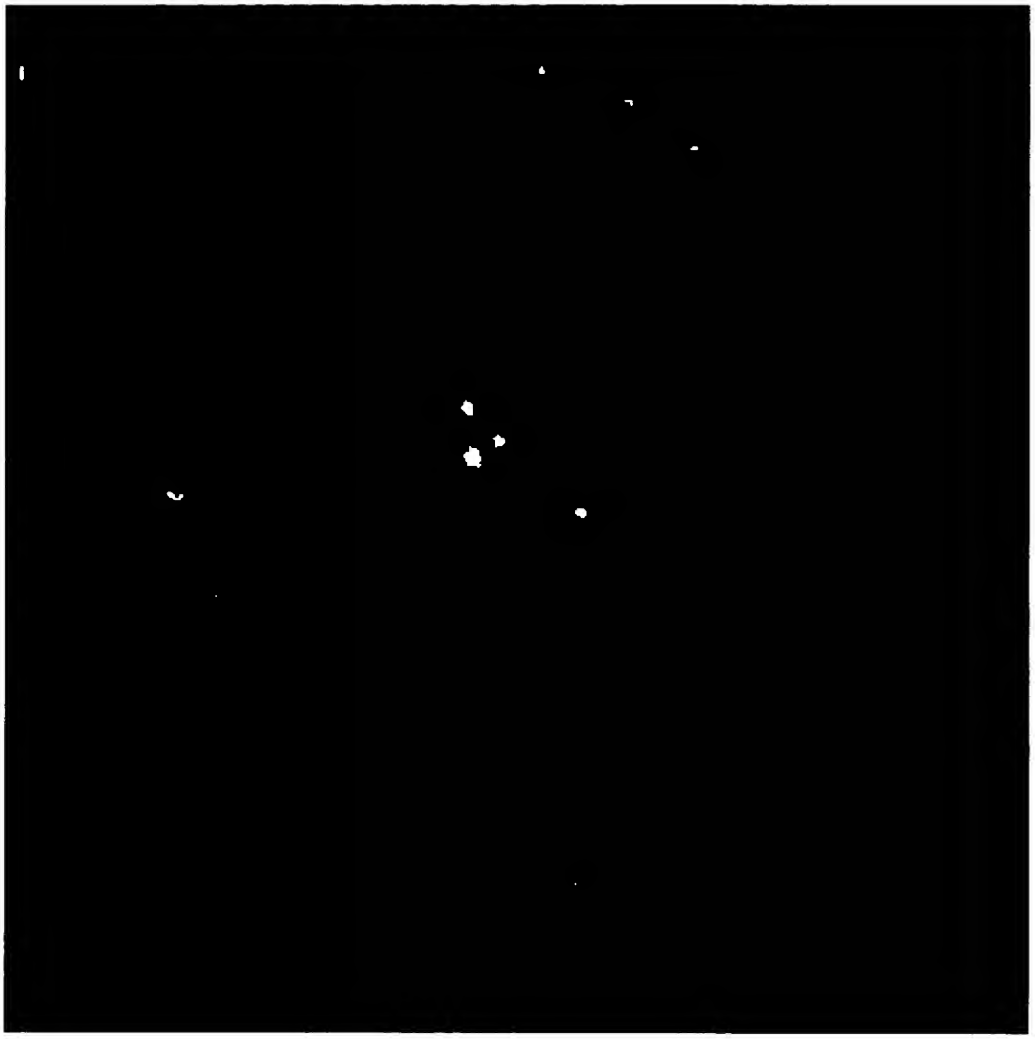


Fig. 16

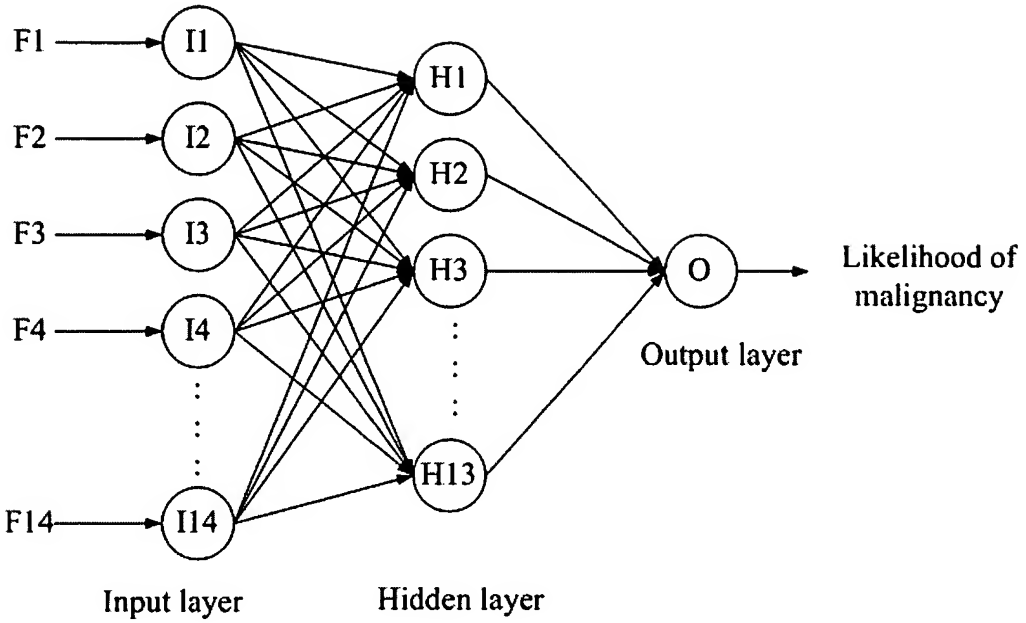

F1
F2
F3
F4
F14
I1
I2
I3
I4
I14
H1
H2
H3
H13
O
Likelihood of malignancy
Input layer
Hidden layer
Output layer

Fig. 17

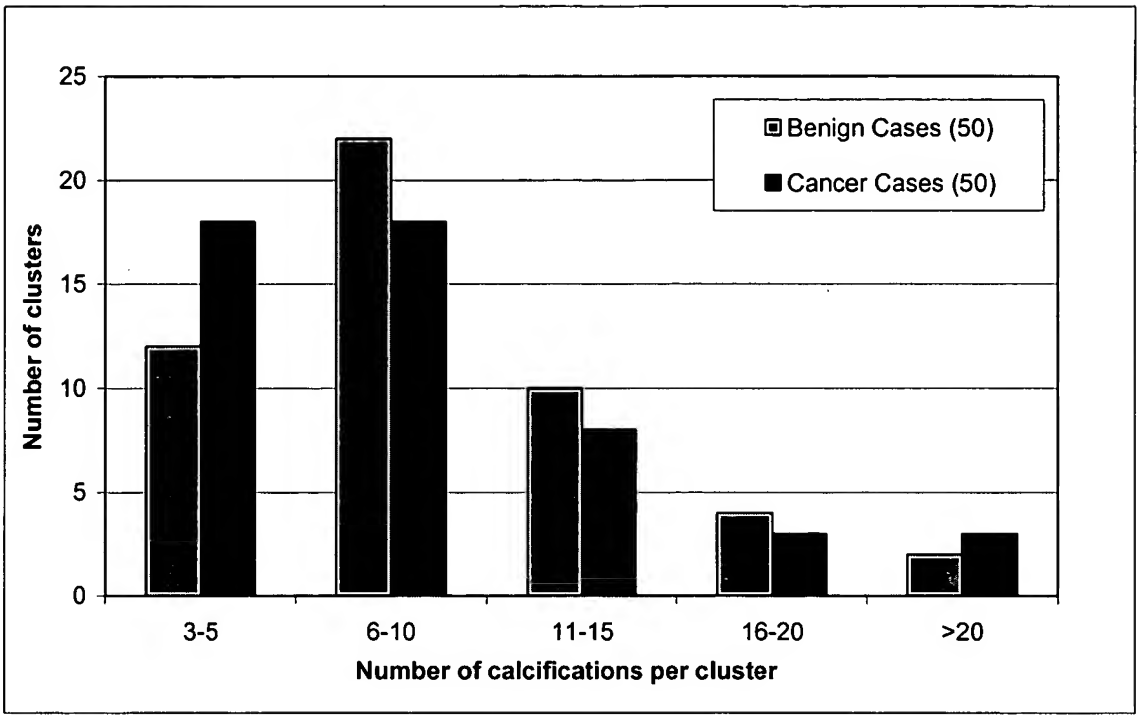

25
20
15
10
5
0
Number of clusters
Benign Cases (50)
Cancer Cases (50)
3-5
6-10
11-15
16-20
>20
Number of calcifications per cluster

Fig. 18

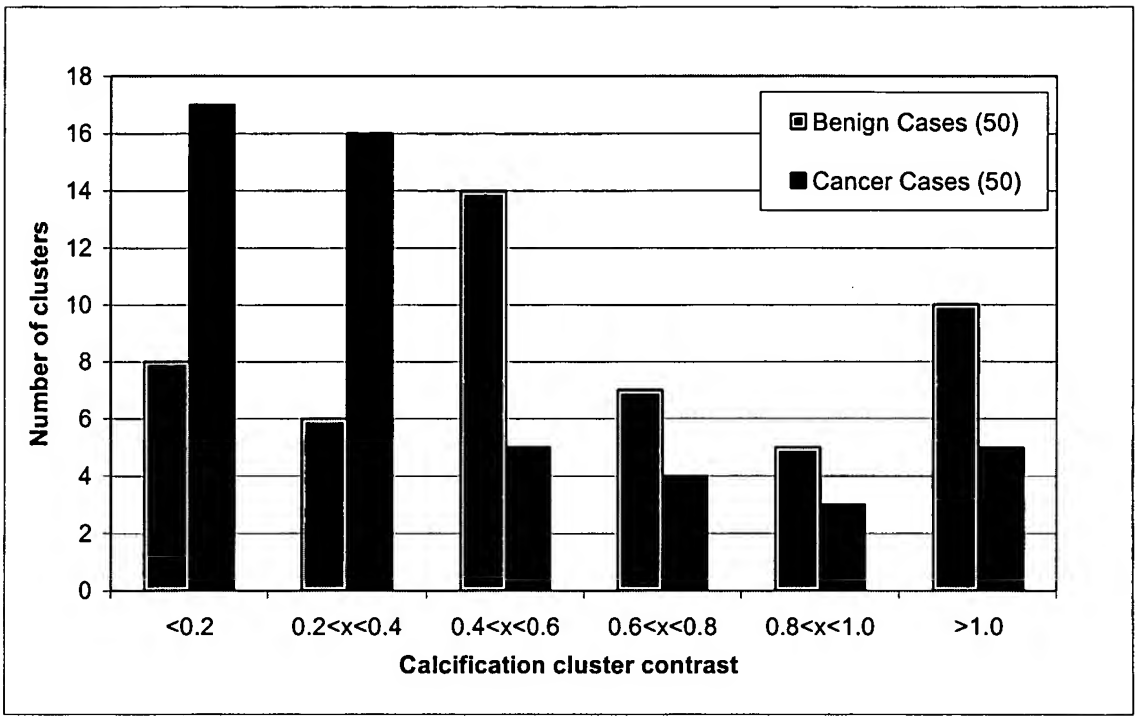

18
16
14
12
10
8
6
4
2
0
Number of clusters
Benign Cases (50)
Cancer Cases (50)
<0.2
0.2<x<0.4
0.4<x<0.6
0.6<x<0.8
0.8<x<1.0
>1.0
Calcification cluster contrast

Fig. 19

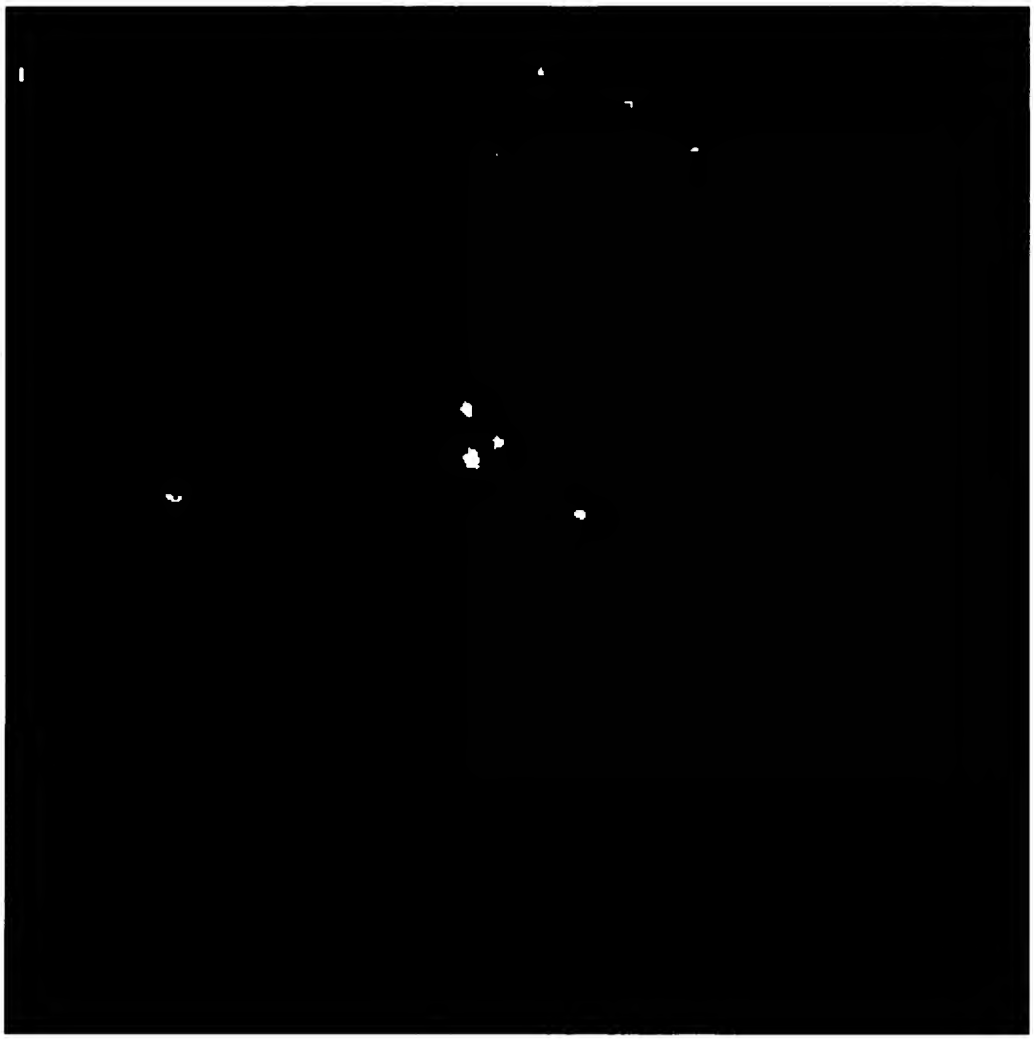


Fig. 20

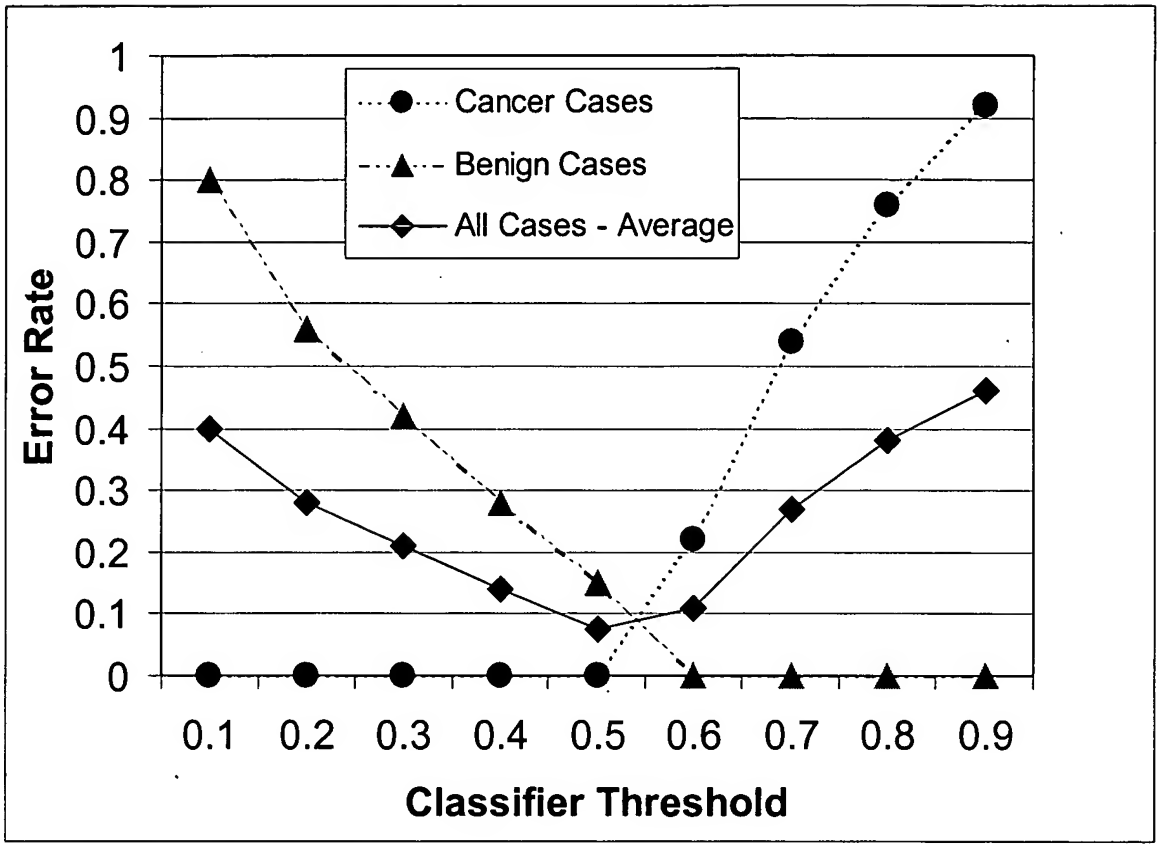

Cancer Cases
Benign Cases
All Cases - Average
Error Rate
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
Classifier Threshold

Fig. 21

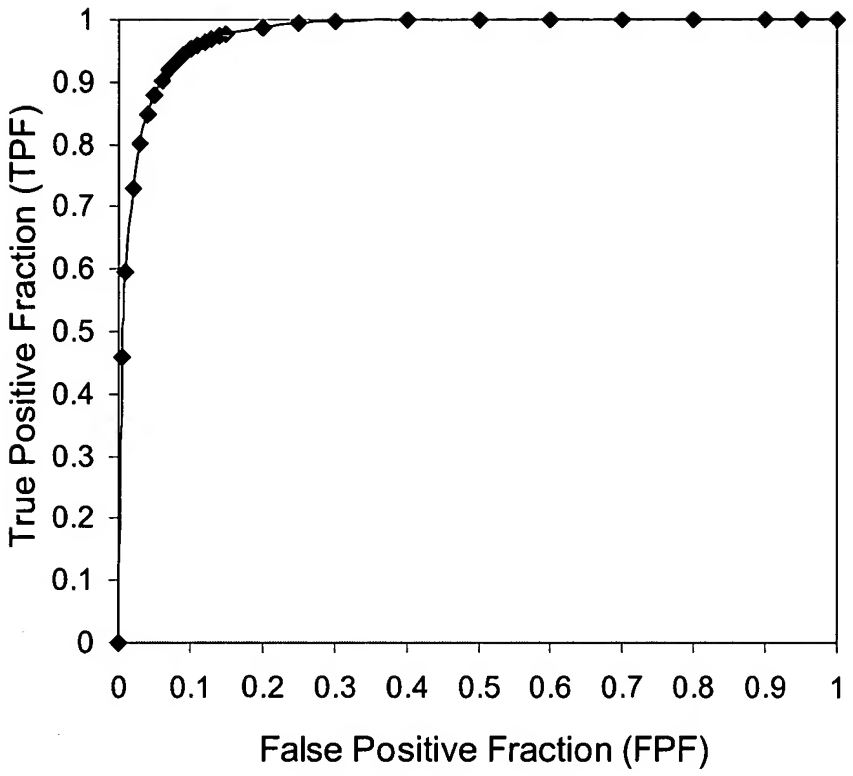

True Positive Fraction (TPF)
False Positive Fraction (FPF)
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1

Fig. 22

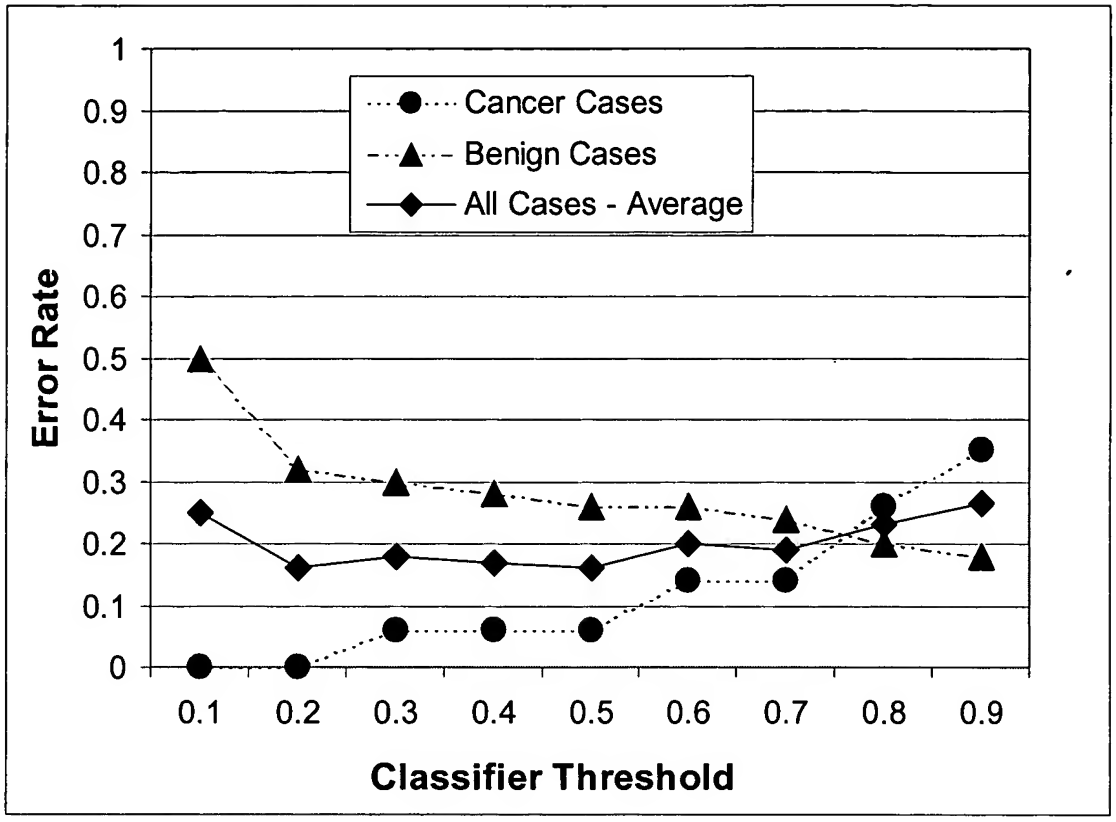

Cancer Cases
Benign Cases
All Cases - Average
Error Rate
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
Classifier Threshold

Fig. 23

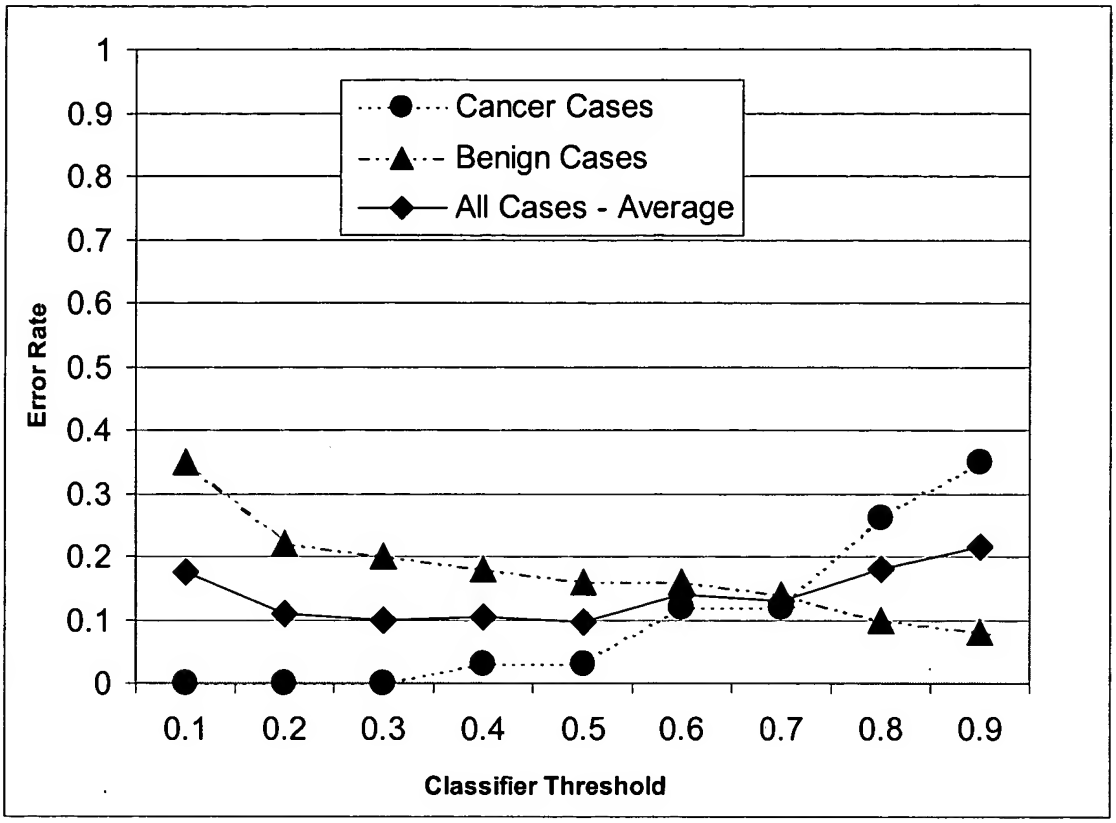

Cancer Cases
Benign Cases
All Cases - Average
Error Rate
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
Classifier Threshold

Fig. 24

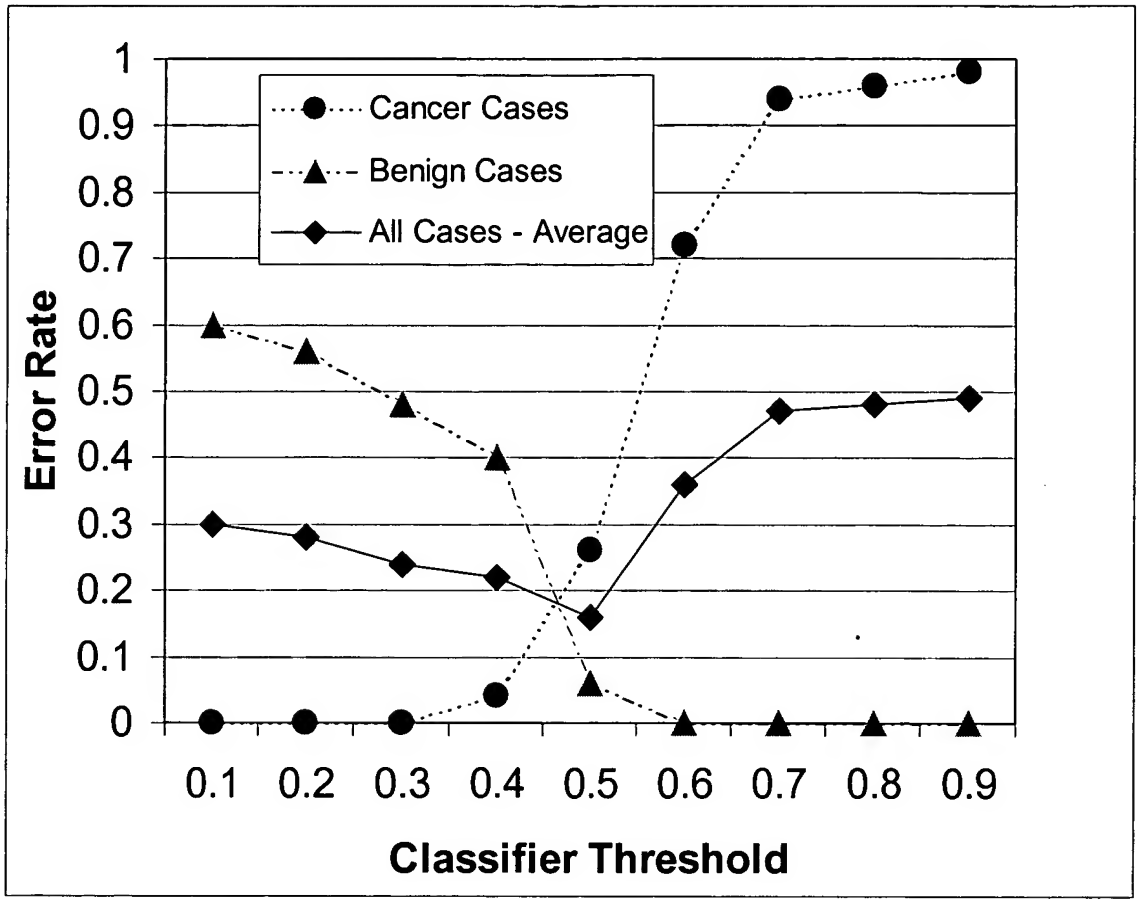

Cancer Cases
Benign Cases
All Cases - Average
Error Rate
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
Classifier Threshold

Fig. 25

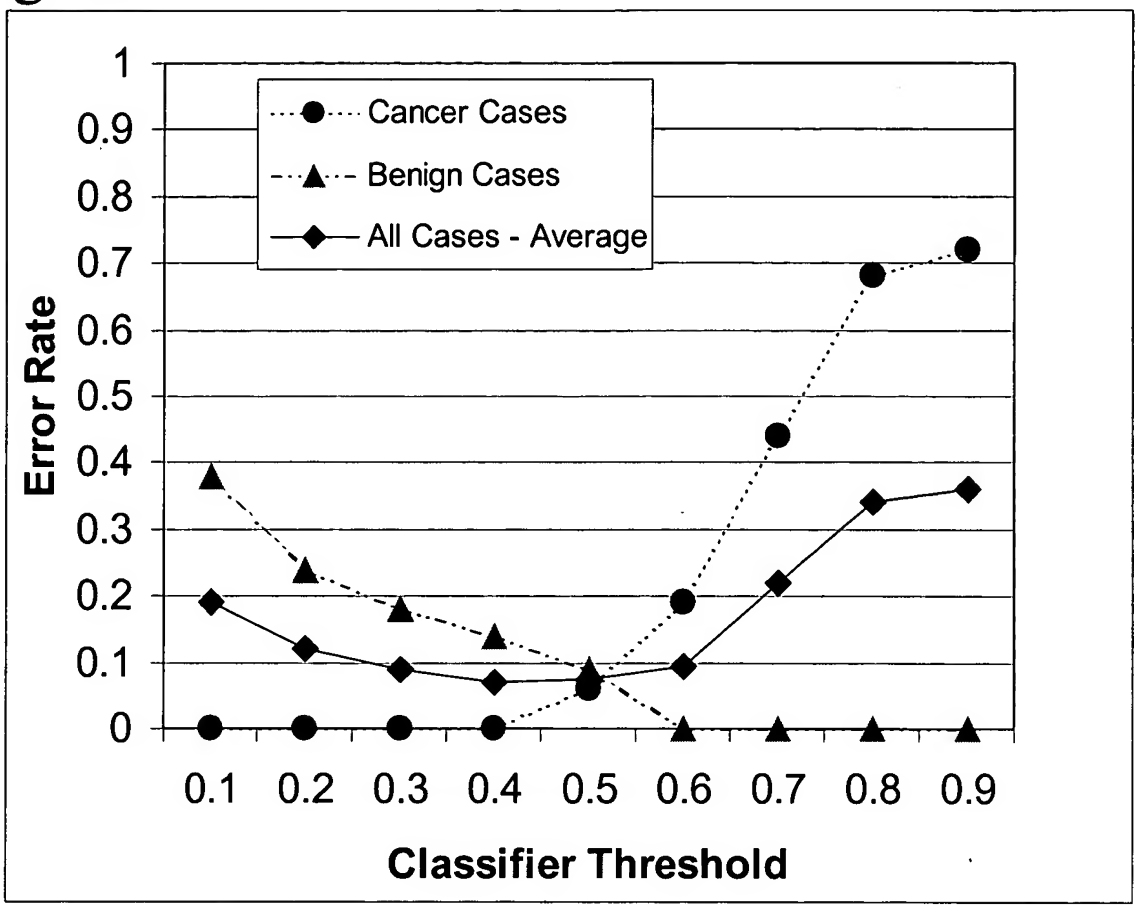
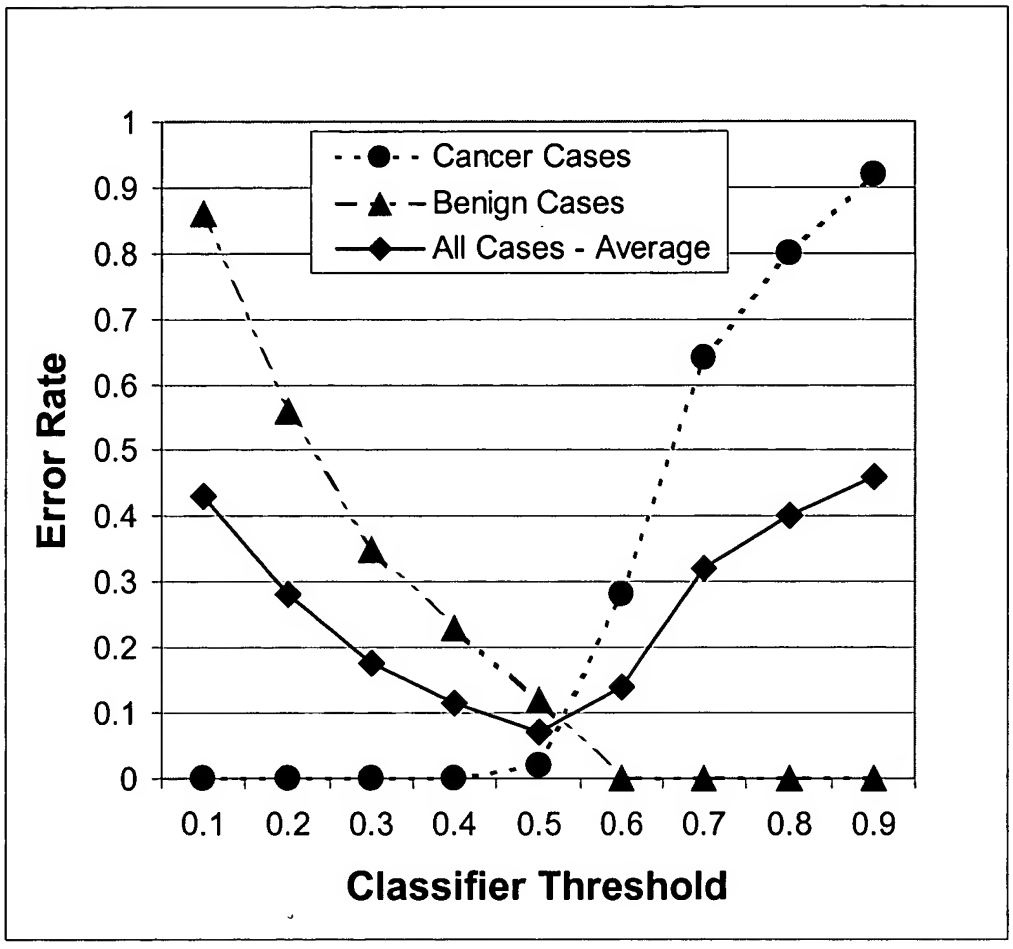

Cancer Cases
Benign Cases
All Cases - Average
Error Rate
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
Classifier Threshold

Fig. 26


Cancer Cases
Benign Cases
All Cases - Average
Error Rate
Classifier Threshold
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9